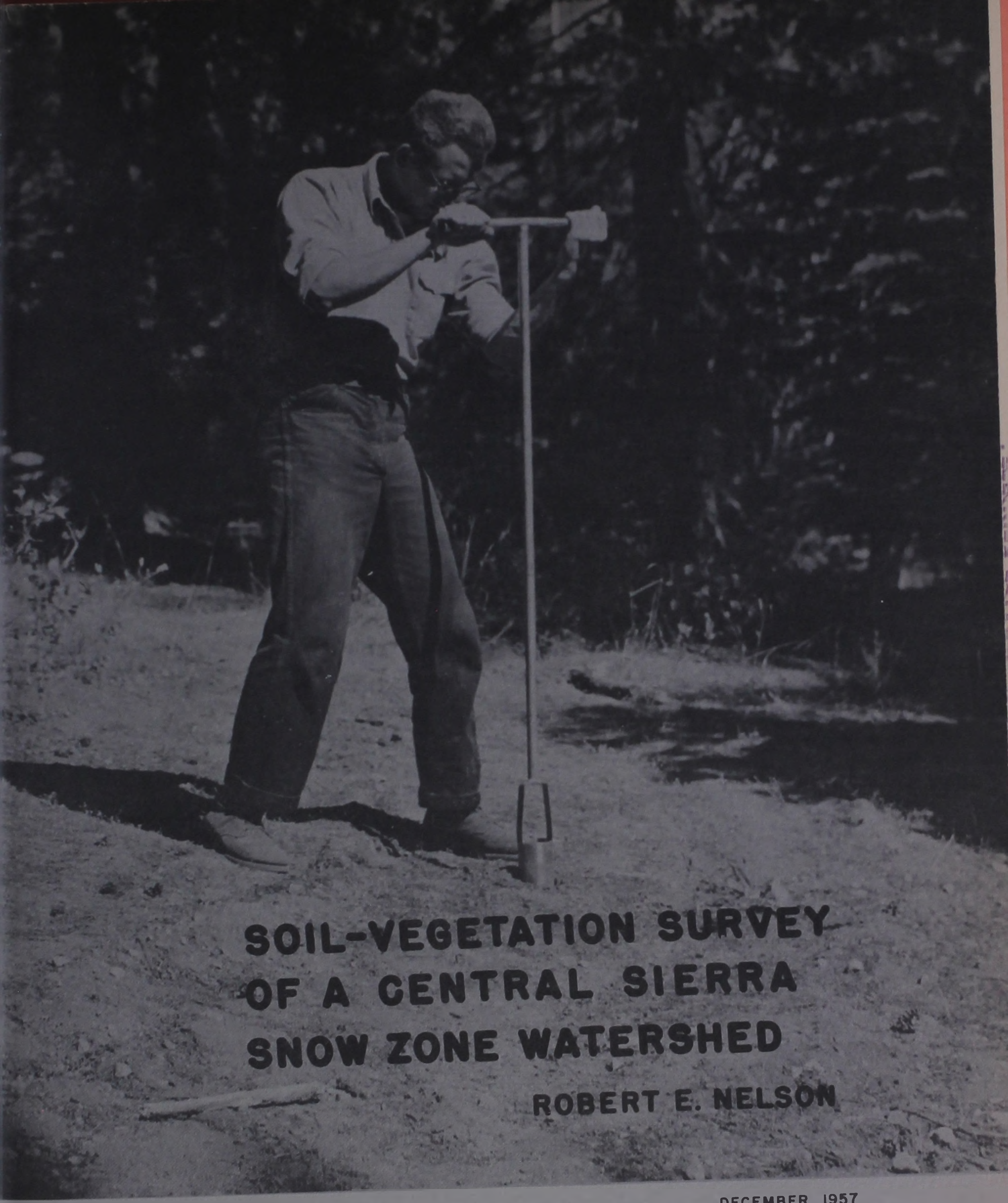

SOIL-VEGETATION SURVEY OF A CENTRAL SIERRA SNOW ZONE WATERSHED

ROBERT E. NELSON

MISCELLANEOUS PAPER NO. 21 DECEMBER 1957

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

in cooperation with

STATE OF CALIFORNIA - DEPARTMENT OF WATER RESOURCES

SOIL-VEGETATION SURVEY

OF A

CENTRAL SIERRA SNOW ZONE WATERSHED

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Agriculture--Forest Service, Berkeley, California

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Of A
CENTRAL SIERRA SNOW ZONE WATERSHED

By
Robert E. Nelson[1/]

INTRODUCTION

Research getting underway at the Central Sierra Snow Laboratory is developing and testing ways to increase the yield of useful water from the snowpack. Some questions being asked are: How can vegetation be managed to improve water yield? How will the effectiveness of management practice vary with the kind of soil? Thus, detailed information is needed on the kinds and extent of vegetation and soils, first in designing studies, then in application of the results to improve water yield.

The soil is a natural reservoir in which water may be stored, from which water may be yielded, and from which water may be lost by evaporation and transpiration. Each kind of soil is a different kind of reservoir. Its characteristics must be known if the most effective methods of improving water yield are to be developed for that soil. Deep soils need different treatment than shallow ones; soils of high water-holding capacity may be more effectively managed than soils of low water-holding capacity.

The vegetation on any soil uses water, yet may serve to make water more usable, as by delaying yield of water in spring and by maintaining good water quality. Management of the vegetation to obtain a desirable balance of quantity, quality, and timing of water yield requires that we know what kind of vegetation we have to work with, its densities, ages, sizes, and types. Then, we can conduct research which will guide specific practices in this vegetation on each kind of soil to the end that water yield will be improved. Knowledge of the vegetation and soils must come first by investigation and survey of the study area.

1/ Forester, Soil-Vegetation Survey Project. Robert A. Gardner, Soil Scientist and Project Chief, Soil-Vegetation Survey Project, participated in the development and review of this survey. Kenneth R. Knoerr, Research Forester, Watershed Management Research Division, assisted in the field mapping.

The Survey

The Soils and vegetation of the Central Sierra Snow Laboratory Basin were classified and mapped in September, 1956[2]. Mapping was done directly on vertical aerial photographs. It was accomplished through stereoscopic study of the photographs and detailed ground examination. The maps produced from this survey are of two kinds, each at a scale of 1:12,000[3]. One, titled "Timber Stand-Vegetation Cover", shows by symbols the age-size-density classes of timber stands, the density of woody vegetation, and broad types of vegetation and other landscape features. The other, titled "Soil-Vegetation", shows by symbols the kinds of soils classified at the soil series and soil phase levels, the species composition of vegetation, and site quality of timber croplands. Legends and other supplemental information, which are a part of this report, provide information for interpreting the maps.

This survey provides the snow management research staff with a basic inventory of the kinds of soils and vegetative cover that can be studied and treated in the experimental area. Therefore snow management research can be tied to specific kinds of vegetative cover and soils when comparing the results of experimental treatment. Furthermore the inventory provides a basis for extending the results of research to other areas of similar vegetation and soils.

Setting

The Central Sierra Snow Laboratory Basin is high in the Sierra Nevada of California near Donner Pass. It comprises that part of the Upper Castle Creek drainage lying above a gaging station on Upper Castle Creek about one-fifth of a mile north of Highway 40 and about one-half mile east of Soda Springs. The area within the basin is about 2,500 acres. The lowest elevation, at the gaging station, is 6,880 feet; the highest elevation, at Castle Peak, is 9,105 feet.

2/ Standards and procedures used on this survey followed, with some modifications, those given in "Field Manual-Soil Vegetation Surveys in California", U. S. Forest Service, California Forest and Range Experiment Station, May 1954, revised Oct., 1954, 99 pp. mimeo.

3/ Reduced scale reproductions of these maps are included with this report. Blue line prints at a scale of 1:12,000 are available on request from: Watershed Management Research Division, California Forest and Range Experiment Station, P.O. Box 245, Berkeley 1, California.

Geology

There are four kinds of bedrock in the basin4/. Intrusive granodiorite of Jurassic age is the oldest rock and was once exposed over the entire area. It is now exposed or lies immediately under the regolith (soil and other loose earth material) in only a part of the area. Volcanic material flowed over the entire area during Miocene and Pliocene times. The first volcanic flows were rhyolitic material, very little of which is exposed or near the surface now. Succeeding volcanic action deposited andesitic material, mainly in the form of mud flows or ash, which consolidated to form agglomerate or tuff-breccia. This andesitic agglomerate is now exposed or immediately underlying the regolith over a large part of the basin. The latest lava flows, of which there are still some remnants, were basaltic.

During Pliestocene times, glaciers removed much of the volcanic material from the area, cutting down to and exposing the granitic bedrock in parts of the area. Glacial debris, consisting mainly of granitic and andesitic material, was deposited in parts of the area as the glaciers receded. Even the deepest of these deposits are not very thick and overlie the granitic or agglomerate bedrock. The present land form (fig. 1) is essentially the result of this glacial action although several depressions scoured out by the glaciers have since been filled with alluvium.

Vegetation and Soils

Vegetation in the Central Sierra Snow Laboratory Basin is typical of that found at the higher elevations in much of the Sierras. A large part of the basin has a forest cover, primarily stands of lodge-pole pine and California red fir. Most stands contain western white pine; some, white fir and Jeffrey pine. The denser stands of trees usually have little understory vegetation. In the more open stands, shrubs and herbaceous vegetation are present in varying amounts. Huckleberry oak, pinemat manzanita, bitter cherry, and mountain whitethorn are the predominant shrubs; huckleberry oak grows only on soils of granitic origin.

In the lower part of the basin remnant tree stumps show that some logging took place years ago. This was probably done in connection with railroad construction or to obtain fuel wood for the railroad locomotives.

4/ For more details of the geology of this area refer to: Corps of Engineers-Weather Bureau. 1951. "Terrain Characteristics - Central Sierra Snow Laboratory Basin". Cooperative Snow Investigations. Technical Report No. 4A. 41pp illus.

Lindgren, W. 1897. Geological Atlas of the United States, Truckee Folio. U.S. Geol. Survey. Folio No. 39. 6pp., illus.

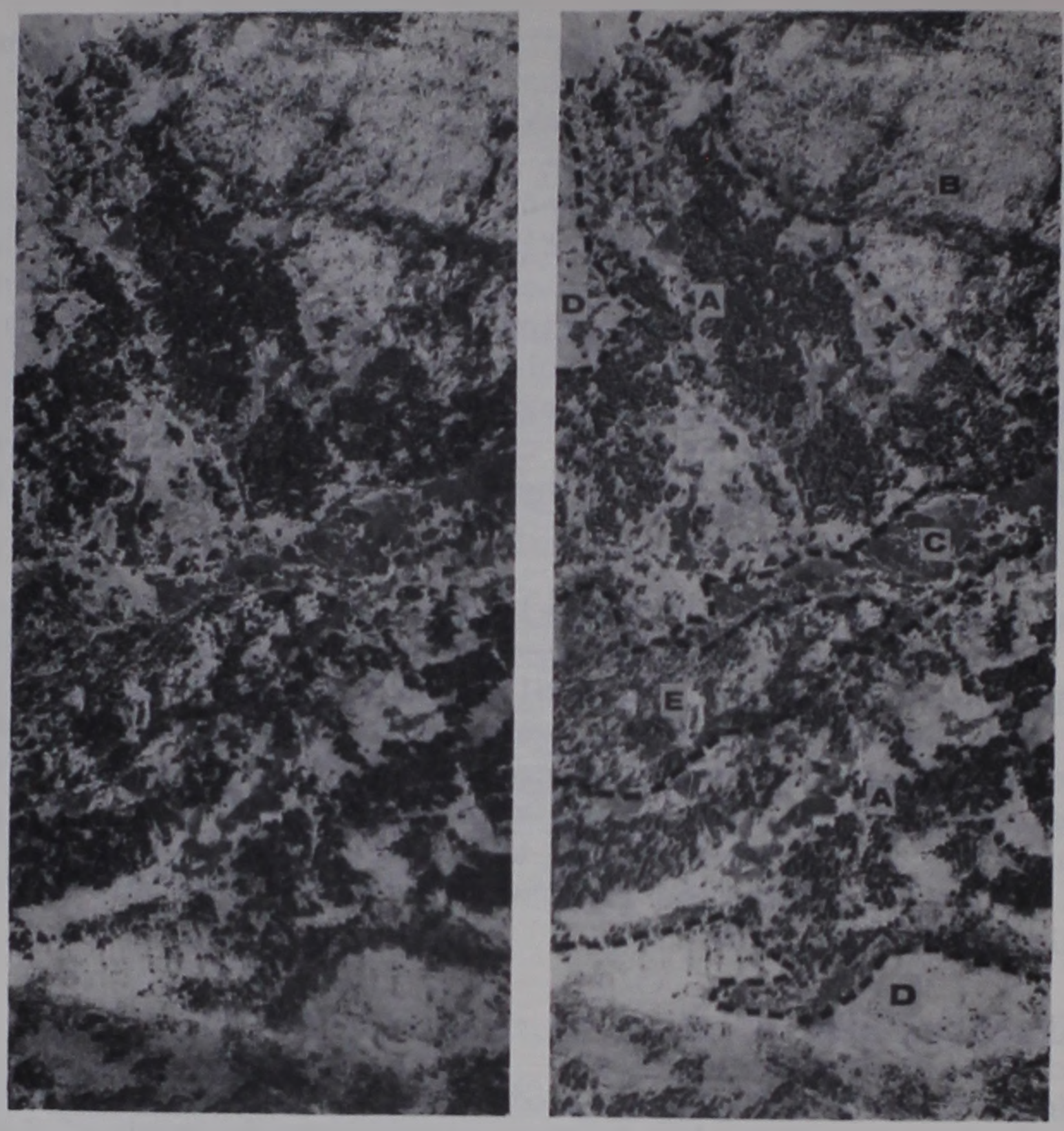


Figure 1. Stereogram from vertical aerial photographs showing land form, soil and geologic pattern, and vegetation pattern in part of the basin.
A--Timbered "Lytton" soils and grass-herb covered "Donner" soils developed from andesitic agglomerate rock.
B--Granitic Rock Land with sparse cover of shrubs and conifer trees.
C--Depression scoured out by glaciers and later filled with alluvium; vegetation is mainly willow shrub.
D--Basic Igneous Rockland with sparse herb and shrub cover; rock is andesitic agglomerate.
E--Timbered "Montez" soils developed from morainal deposits and Granitic Rock land with sparse cover of shrubs and conifer trees. Scale of photographs approx. 1:20,000. North is to the left.

Much of the basin is essentially treeless. Some areas, including most of the steep, rocky slopes, have only a sparse herbaceous or shrubby cover, primarily wooly mules' ears, pacific monardella, sagebrush, wild-buckwheat, and California helianthella. The several meadows in the basin have a relatively dense grass and forb cover, usually with some California false-hellebore. A list of the plant species identified in the basin is attached at the end of this report.

Soils are of several different kinds. The four most extensive of these are named tentatively as new soil series. They are:

1. The forested "Lytton" soils (fig. 2) which occur on about one-fourth of the basin area. They are well drained, strongly acid, moderately coarse textured, dark soils developed in place from andesitic agglomerate rock.

2. The grass-herb covered "Donner" soils (fig. 3) which occur on about one-tenth of the basin area. They are well drained, moderately acid, medium textured, brown soils also developed in place from andesitic agglomerate rock.

3. The forested "Judah" soils (fig. 4) which occur on about one-tenth of the basin area. They are dark, well drained, strongly acid, moderately coarse textured and rocky soils developed in place from granitic rock.

4. The forested "Montez" soils which occur on about one-tenth of the basin area. They are similar to the "Judah" but are developed from morainal deposits and are extremely bouldery.

No attempt will be made to correlate and establish these soil series as part of the National system for the time being, since the area investigated is relatively small. However, there is little doubt that they represent new kinds of soils, fairly extensive in the general vicinity, and subject to establishment on further and more extensive investigation.

Some soils, even though distinctive, are of such minor extent that they are not named but are shown by separate symbol on the map and legend sheets. Also, much of the basin area has little or no natural soil. These miscellaneous land types are classified and mapped as to kind of rock material as well as type of land. More detailed descriptions of the soils and miscellaneous land types and their associated vegetative cover are given later in this report.

Figures 5 and 6 are stereograms from vertical aerial photographs showing the vegetative cover types on different soils and miscellaneous land types.

Figure 2.--Typical forest cover and ground condition in an area of "Lytton" soil.

Figure 3.--Grass-herb covered "Donner" soil in left foreground. Dense young-growth stand of California red fir growing on "Lytton" soil in background.

Figure 4.--Typical vegetative cover and rockiness in an area of "Judah" soil.

Soil Laboratory Data

Soil samples for laboratory analyses were not collected during the survey work, consequently the soil investigation part of the survey is incomplete. It is planned that such soil samples will be collected in the near future as part of the snow management research program. These soil samples will be taken to measure the water holding capacity, available water, and other hydrological characteristics of the soils and underlying rock material. These data, together with the vegetation and other soils data, will permit determination of water losses for the various soil and vegetation types. Other laboratory analyses will be made as needed.

BASE MAP AND AERIAL PHOTOGRAPHS

The base map used to prepare the Timber Stand-Vegetation Cover and Soil-Vegetation maps was made in 1946 by the U. S. Corps of Engineers, Sacramento, California. The map used was at a scale of 1:12,000.

Field mapping was done on vertical aerial photographs at a scale of about 1:10,000. This aerial photography was done by the U. S. Forest Service in August, 1956. Every effort has been made to fit the mapping boundaries on the photos to the topography of the base map. The location of the centers of the photos used for mapping are shown on the maps by a large dot.

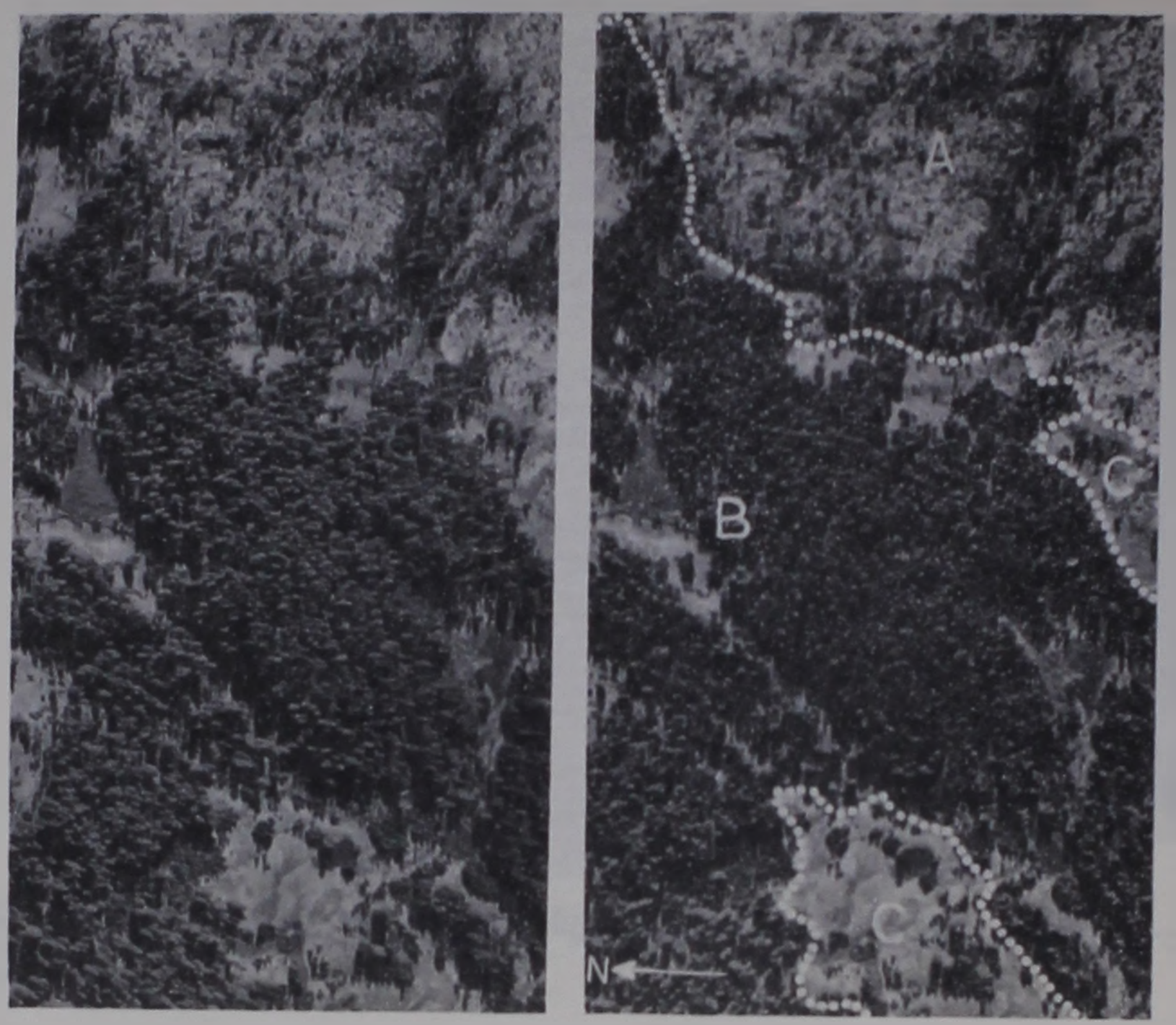


Figure 5.--Stereogram from vertical aerial photographs illustrating vegetation and other land features of Granitic Rock Land (area A), "Lytton" soils (area B) and "Donner" soils (areas C). Scale approx. 1:10,000.

Contour lines, small drainages and other map details could not be shown on the soil-vegetation survey maps without obliterating other data. Reference should be made to the source base map for such details. Some special features are shown on the maps for orientation or other purposes as follows:

Feature	Map Symbol
Spring	
Small marshy or wet spot	
Prominent rock outcrop	
Rock escarpment	
Pond	
Named peak and/or bench mark	
Other prominent peaks	

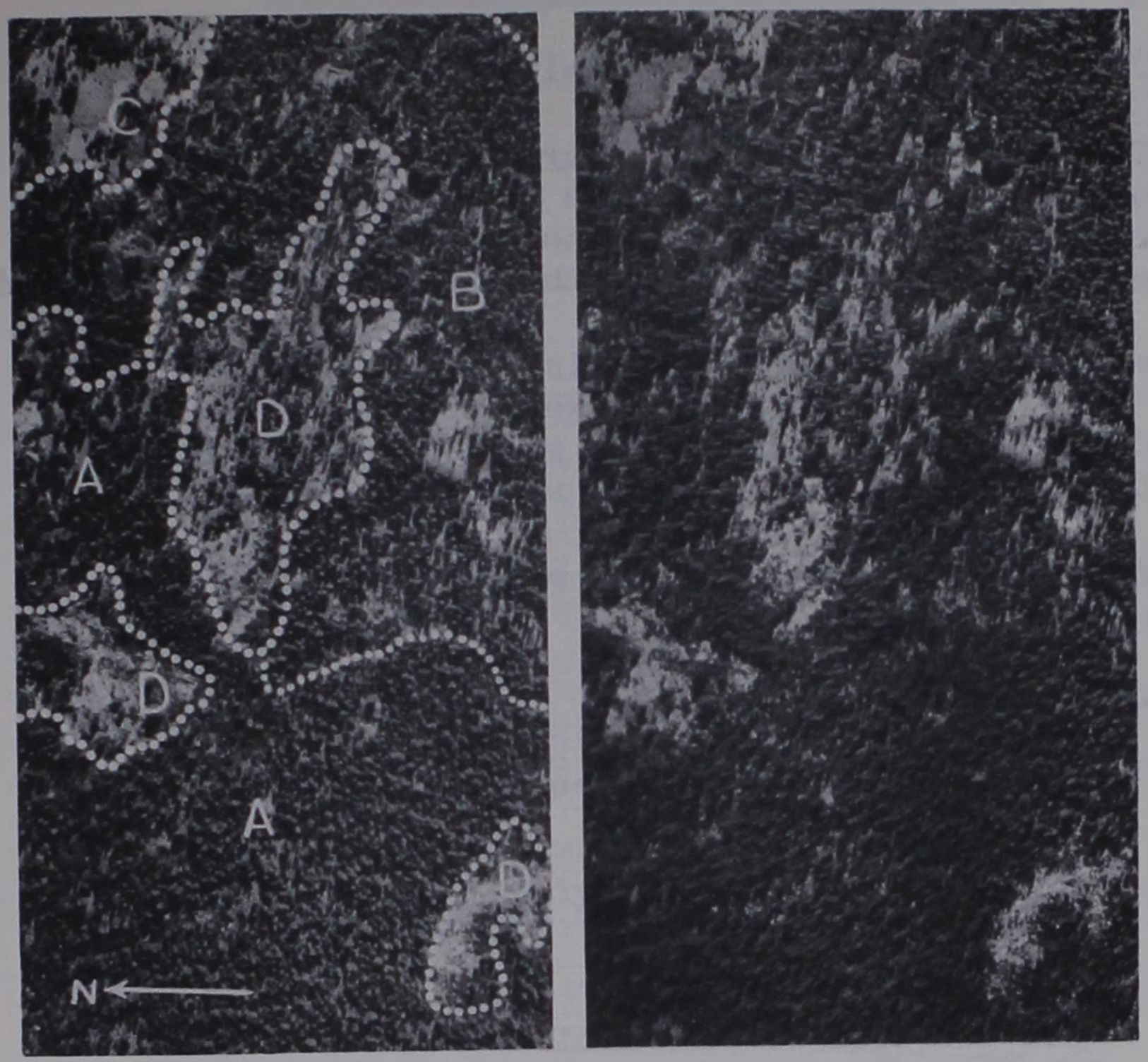


Figure 6.--Stereogram from vertical aerial photographs showing vegetative cover types on "Judah" soils (area A), "Montez" soils (area B), "Donner" and "Lytton" soils (area C) and Granitic Rock Land (areas D). Scale approx. 1:10,000.

THE TIMBER STAND-VEGETATION COVER MAP

(Legend and Supplemental Information)

The Timber Stand-Vegetation cover map shows information obtained from stereoscopic study of the aerial photographs of the area, supplemented by field observations. Mapping intensity was to a minimum of about 2-1/2 acres for the smallest area delineated.

The classification symbols consist of letters and numbers arranged in the form of a fraction, like YO422/CB, Y332/CBS, N4/BFS, N-3/RSC, and N5/R. One set of symbols appears on the map in each of the delineated areas.5/ The symbols indicate:

1. What kinds of vegetation or other land features occupy the areas.

2. Whether:

    a. The areas can produce conifer timber crops.

    b. The timber croplands now have timber stands.

    c. The tree-covered nontimber lands have terrain favorable to harvesting the trees.

3. The age-size structures and densities of the conifer timber stands on timber croplands.

4. The densities of the total woody vegetation cover on all lands.

BROAD TYPES OF VEGETATION AND OTHER LANDSCAPE FEATURES are indicated in order of abundance, as viewed from above, by large letters in the denominator of symbols. These symbols and their meanings are as follows:

C - Conifer trees--Crowns of conifer trees occupy 5 percent or more of the ground space.

5/ In some areas an association of two distinct units as defined by the cover classification system cannot be shown separately at the scale of mapping. In such areas of cover complexes, two classification symbols are shown, separated by a short vertical line.

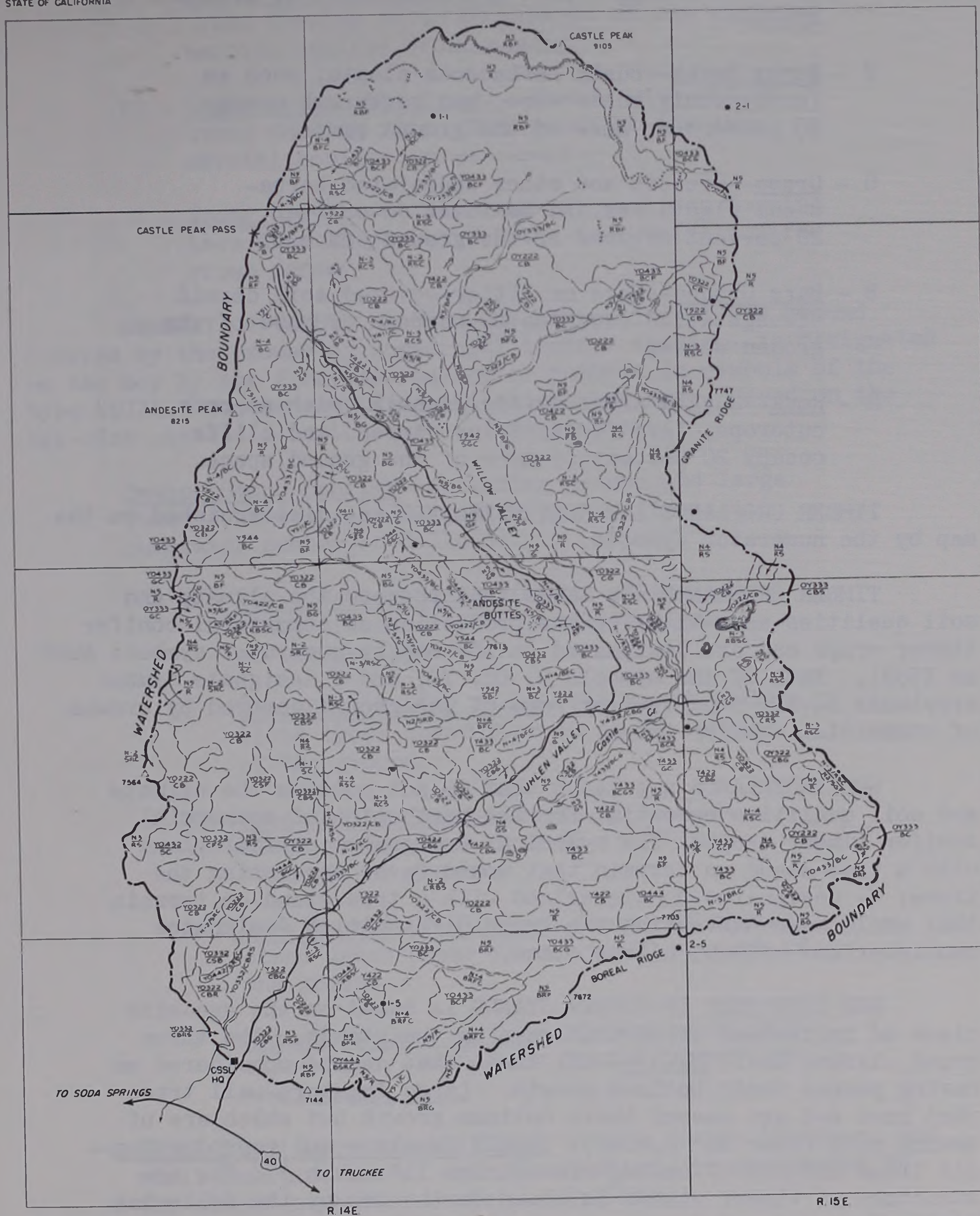
TIMBER STAND-VEGETATION COVER

CENTRAL SIERRA SNOW LABORATORY BASIN

SOIL - VEGETATION SURVEY

CALIFORNIA FOREST & RANGE EXPERIMENT STATION -
FOREST SERVICE - U S DEPARTMENT OF AGRICULTURE
IN COOPERATION WITH
DEPARTMENT OF WATER RESOURCES -
STATE OF CALIFORNIA

AGE AND DENSITY CLASSES OF TIMBER STANDS
DENSITY OF WOODY VEGETATION
BROAD TYPES OF VEGETATION AND OTHER ELEMENTS

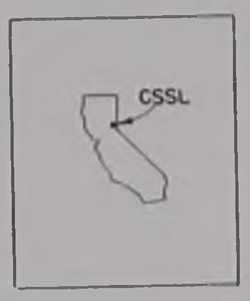


Classification and mapping by: R. Nelson, assisted by K. Knoerr, 1956
Map compilation by: C. Lukermann, 1956
Edition of: December, 1956

0 1000 2000 3000 FEET

Roads
Air Photo Centers

Base map: U.S. Engineer Office, Sacramento, California, 1946
Land grid: U.S. Engineer Office, Sacramento, California, 1946
Aerial photography: U.S. Forest Service, 1956
Mt. Diablo Meridian



S - Shrubs--Shrubs, such as manzanitas, scrub oaks, and willows occupy 20 percent or more of the ground space between trees or in the absence of trees occupy 5 percent or more of the ground space.

F - Bushy Herbs--Bushy herbaceous plants, such as ferns, wooly mules ears, and sagebrush occupy 20 percent or more of the ground space.

G - Grass--Grasses and other associated herbaceous plants are the dominant cover over 20 percent or more of the ground space.

B - Bare Ground--Bare or litter-covered soil devoid of vegetation occupies 20 percent or more of the ground space.

R - Rock--Rugged areas devoid of soil, such as rock outcrops, lava flows, talus slopes, and cliffs occupy 20 percent or more of the ground space.

TIMBER CROPLANDS AND NONTIMBERLANDS are distinguished on the map by the numerator symbols.

TIMBER CROPLANDS are lands that possess the climate and soil qualities essential for the production of commercial conifer timber crops and are designated on the map by numerator symbols such as YO321. Each of the symbols O, OY, YO, and Y designate timber croplands having 5 percent or more of the ground covered by crowns of commercial conifer trees.

NONTIMBERLANDS are lands that do not possess the climate and soil qualities essential for the production of commercial conifer timber crops. The symbol N+ designates nontimberland with a tree stand on terrain that would favor harvesting the trees; N- designates nontimberland with a tree stand on terrain that would make harvesting the trees difficult; N designates nontimberland without a tree stand.

AGE STRUCTURE OF TIMBER STANDS is based on the age-size class of individual trees that make up the stands. The three broad classes are: Mature--all trees that can be considered as having passed their optimum growth. Large immature--all trees that have not yet passed their optimum growth but which are of sawlog size (over 11" d.b.h.). Small immature and reproduction--all trees not yet of sawlog size (under 11" d.b.h.). The age structure of timber stands is shown on the map by the following symbols:

O - Old Growth--Stands with mature trees forming 80 percent or more of the commercial conifer crown canopy.

OY - Old Growth-Young Growth--Stands with mature trees forming 50 to 80 percent of the commercial conifer crown canopy.

YO - Young Growth-Old Growth--Stands with mature trees forming 20 to 50 percent of the commercial conifer crown canopy.

Y - Young Growth--Stands with mature trees forming less than 20 percent of the commercial conifer crown canopy.

DENSITY OF TIMBER STANDS--the proportion of the ground covered by the crowns of commercial conifer species--is designated on the map by the first two numerator numbers in symbols of the type YO321. Two density classifications are made, based on the age-size classes described above. These are:

Sawlog Stand Density--including mature and large immature trees--is designated by the first numerator number as follows:

1 - Dense Sawlog Stand--Crowns of sawlog-sized trees cover 80 percent or more of the ground.

2 - Semidense Sawlog Stand--Crowns of sawlog-sized trees cover from 50 to 80 percent of the ground.

3 - Open Sawlog Stand--Crowns of Sawlog-sized trees cover from 20 to 50 percent of the ground.

4 - Very Open Sawlog Stand--Crowns of sawlog-sized trees cover from 5 to 20 percent of the ground.

5 - Extremely Open or None--Crowns of sawlog-sized trees cover less than 5 percent of the ground.

Total Stand Density--including mature, large immature, and small immature trees, and reproduction--is designated by the second numerator number as follows:

1 - Dense Total Stand--Crowns of all-sized trees cover 80 percent or more of the ground.

2 - Semidense Total Stand--Crowns of all-sized trees cover from 50 to 80 percent of the ground.

3 - Open Total Stand--Crowns of all-sized trees cover from 20 to 50 percent of the ground.

4 - Very Open Total Stand--Crowns of all-sized trees cover from 5 to 20 percent of the ground.

5 - Extremely Open or None--Crowns of all-sized trees, if present, cover less than 5 percent of the ground.

DENSITY OF TOTAL WOODY VEGETATION COVER--the proportion of the ground covered by all trees and shrubs combined--is shown for all lands. It is designated on the map by the last numerator number as follows:

1 - Dense Woody Vegetation Cover--The canopy of all trees and shrubs combined cover 80 percent or more of the ground.

2 - Semidense Woody Vegetation Cover--The canopy of all trees and shrubs combined covers from 50 to 80 percent of the ground.

3 - Open Woody Vegetation Cover--The canopy of all trees and shrubs combined covers from 20 to 50 percent of the ground.

4 - Very Open Woody Vegetation Cover--The canopy of all trees and shrubs combined covers from 5 to 20 percent of the ground.

5 - Extremely Open or No Woody Vegetation Cover--The canopy of all trees and shrubs combined covers less than 5 percent of the ground.

EXAMPLE OF COVER CLASSIFICATION SYMBOL

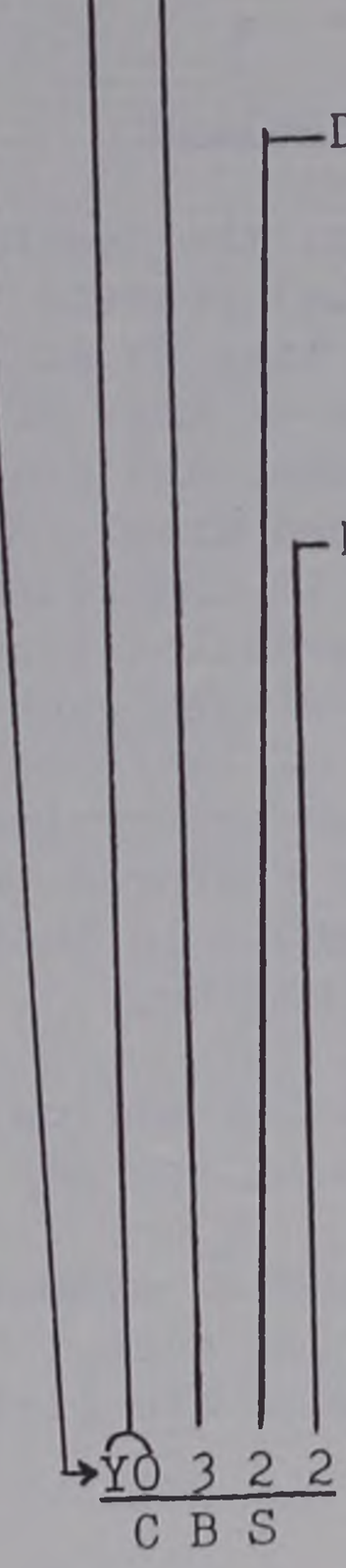
AGE STRUCTURE OF TIMBER
- O - Old Growth
- OY - Old Growth-Young Growth
- YO - Young Growth-Old Growth
- Y - Young Growth

NONTIMBERLANDS
- N+ with tree stands on gentle terrain
- N- with tree stands on rugged terrain
- N without tree stands

DENSITY OF SAWLOG TIMBER
- 1 - Dense
- 2 - Semidense
- 3 - Open
- 4 - Very Open
- 5 - Extremely Open or None

DENSITY OF ALL TIMBER
- 1 - Dense
- 2 - Semidense
- 3 - Open
- 4 - Very Open
- 5 - Extremely Open or None

DENSITY OF TOTAL WOODY VEGETATION
- 1 - Dense
- 2 - Semidense
- 3 - Open
- 4 - Very Open
- 5 - Extremely Open or None



VEGETATION COVER AND OTHER LAND FEATURES

- C - Conifers
- S - Shrubs
- F - Bushy Herbs and sagebrush
- G - Grass
- B - Bare Ground
- R - Rock

THE SOIL-VEGETATION MAP

(Legend and Supplemental Information)

The soil-vegetation map shows information obtained from field study supplemented by stereoscopic study of the aerial photographs of the area. Mapping intensity was to a minimum of about 2-1/2 acres for the smallest area delineated.

Vegetation

On the Soil-Vegetation map, the dominant plant species (excluding grass and associated herbs) present in each delineated area are indicated by letter symbols, like Qv An and L R W' Pta Qv.6/ Each delineated area may have one or more broad vegetation types (conifer trees, shrubs, bushy herbs, and grass) each of which covers from 5 to 100 percent of the ground area. Any species is considered dominant in a delineated area if it comprises 20 percent or more of the cover formed by the broad vegetation type to which it belongs. The order of the species symbols within each broad vegetation-type indicates the relative abundance of the species. Symbols of broad vegetation types not classified as to species (grass and certain bushy herbs), and other landscape features (bare ground and rock), are included with the species symbols in their proper order of abundance, or alone, as the case may be.

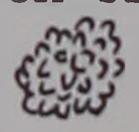
The location of small areas of willow, alder or aspen brush, too small to delineate, are shown on the map by hatching: 

Table 1 lists the plant species symbols occurring on the map, with common and scientific names for each. Sprouting characteristics and browse values7/ of these species are listed. Other symbols are defined at the end of the table.

6/ In some areas distinct vegetation units cannot be shown separately at the scale of mapping. In such areas two groups of letter symbols are shown.

7/ Ratings of Browse Values by Dr. A. W. Sampson, Professor of Forestry, Emeritus (Range Management), School of Forestry, University of California.

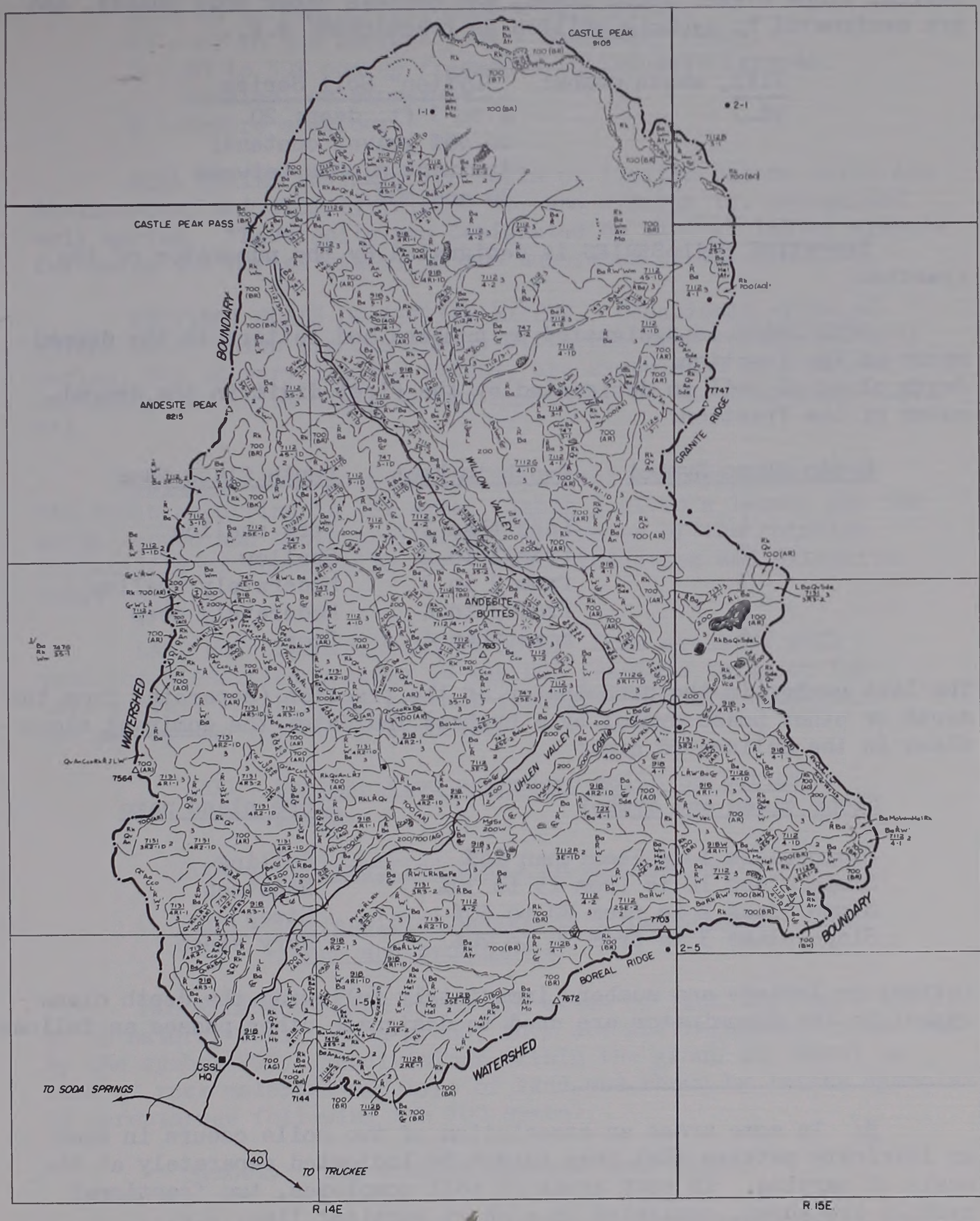
SOIL-VEGETATION

CENTRAL SIERRA SNOW LABORATORY BASIN

SOIL-VEGETATION SURVEY

CALIFORNIA FOREST & RANGE EXPERIMENT STATION -
FOREST SERVICE - U.S. DEPARTMENT OF AGRICULTURE
IN COOPERATION WITH
DEPARTMENT OF WATER RESOURCES -
STATE OF CALIFORNIA

SPECIES COMPOSITION OF VEGETATION
SOIL SERIES AND PHASES
SITE QUALITY OF TIMBER CROPLANDS



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Map compilation by: C. Lukermann, D. Mullen, 1956.
Edition of: December, 1956.

0 1000 2000 3000 FEET

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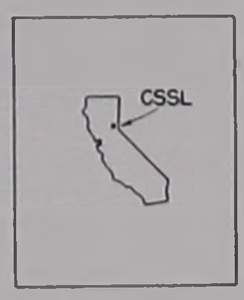

Soils

The soils are classified and mapped according to tentative soil series, slope class, depth class, and certain other soil phases, and are designated by symbols written as fractions[8] e.g.,

7112, which means:	"Lytton" Soil Series
3S-2	2 to 3 ft. deep; 20 to 50% gravel content; dominant slopes between 30 and 50%.

TENTATIVE SOIL SERIES is designated by the numerator of the fraction.

SOIL PHASE is designated by numbers and letters in the denominator of the fraction.
Depth class of soil is designated by the first digit in the denominator of the fraction:

Depth Class Symbol	Depth in Feet	Depth Class Name
1	Less than 1	Very shallow
2	from 1 to 2	Shallow
3	from 2 to 3	Moderately shallow
4	from 3 to 4	Moderately deep
5	more than 4	Deep

The last number in the denominator of the fraction (separated from the depth or other phase symbol by a hyphen) indicates the dominant slope class in the delineated area:

Slope class and Symbol	Slope class name
Slope class 1 is less than 15%	Rolling
Slope class 1D is from 15 to 30%	Nonsteep
Slope class 2 is from 30 to 50%	Steep
Slope class 3 is from 50 to 70%	Very steep

Letters or letters and numbers immediately following the depth class symbol in the denominator are used to designate other phases as follows:

8/ In some areas an association of two soils occurs in such an intricate pattern that they cannot be indicated separately at the scale of mapping. In such areas of soil complexes, two fractional symbols are shown, separated by a short vertical line, e.g.,

747R	747W
3-2	3-2

R = 10 to 50% surface rock - very rocky to extremely rocky (undifferentiated).
R1 = 2 to 10% surface rock - rocky.
R2 = 10 to 25% surface rock - very rocky.
R3 = 25 to 50% surface rock - extremely rocky.
S = 20 to 50% coarse fragments in the soil (gravel, cobbles, or stones).
E = Severe erosion.

SOIL SERIES VARIANTS are soils of limited extent which are distinctive, but closely related to, and similar to, recognized soil series. These soils are designated by capital letter symbols following the series symbol in the numerator of the fraction.

DISTINCT SOILS OF LIMITED EXTENT. Occasional areas of upland soils which are distinctly different from recognized soil series, but of very limited extent, are symbolized by a letter replacing the third digit in the numerator of the fraction, e.g., 75X.

Table 2 lists some of the important characteristics of the soils occurring in the area. Table 3 gives a legend for the soils mapped and shows preliminary estimates of the relative suitability of these soils for timber production and extensive range use.

LAND NOT CLASSIFIED AS TO SOIL. Some areas of soil were not classified because it was not feasible to do so for this survey. Such areas are not extensive and are shown on the map by the following symbols:

200 - Unclassified secondary soils on bottom lands.

200W - Unclassified soils in wet meadows.

400 - Unclassified secondary soils on terraces and benchlands.

MISCELLANEOUS LAND TYPES are areas of land that have little or no natural soil. As a group, they are distinguished on the map by the symbol 700. Subdivisions within the group are based on kind of rock material and type of land and shown by letter symbols in parentheses following the 700 symbol.

Symbol: 700 - Miscellaneous land types.

Subdivisions (Symbols in parentheses)

Symbol	Kind of Rock Material
A	Acid igneous
B	Basic igneous

Symbol	Kind of Land9/
G	Moraine (Rubbleland) (50-90% stoniness)
K	Colluvial land
O	Rock outcrop (90-100% rockiness)
R	Rock land (50-90% rockiness)
T	Talus (rubbleland)

Example: 700 (BK) - Colluvial land of basic igneous rock material.

Timber sites

SITE QUALITY OF TIMBER CROPLANDS--the capacity of the land for growing timber crops--is indicated on the map by single-number symbols (Arabic), like 4. The site quality for each timber cropland area is designated as follows:

Site-class symbol	Site Index: Height in feet of dominant trees at 300 years	Corresponding site class symbols used by USFS-R-5
1	75	V
2	100	IV
3	125	III
4	150	II
5	175	I
6	200	IA

9/ In general, miscellaneous land types are based on names and definitions given in the Soil Survey Manual, USDA Handbook No. 18, 1951.

Map Symbol:	Common name	Scientific name
Aa	Western service berry	Amelanchier alnifolia
Acg	Dwarf maple	Acer glabrum
An	Pinemat manzanita	Arctostaphylos nevadensis
Ate	Mountain alder	Alnus tenuifolia
Atr	Big sagebrush	Artemisia tridentata
Cco	Mountain whitethorn	Ceanothus cordulatus
Hel	California helianthella	Helianthella californica var. nevadensis
Hm	Mountain hemlock	Tsuga mertensiana
J	Jeffrey pine	Pinus Jeffreyi
Jo	Western juniper	Juniperus occidentalis
L	Lodgepole pine	Pinus contorta
Mo	Pacific monardella	Monardella odoratissima
Pe	Bitter cherry	Prunus emarginata
Pta	Bracken	Pteridium aquilinum pubescens

Table 1 (continued)

Map symbol	Common name	Scientific name	Habit of growth[1]	Post-fire sprouting[2]	CENTRAL SIERRA SNOW LABORATORY BASIN Browse value[3] H	C	S	G	D
Ptr	Quaking aspen	Populus tremuloides	S	Spr	3-4	2-3	1-2	1-2	1-2
Qv	Huckleberry oak	Quercus vaccinifolia	S	Spr	5	4-5	4-5	3-4	3-4
R̂	California red fir	Abies magnifica[4]	T	N-Spr	5	4-5	4-5	3-5	3-5
Sar	Mountain snowberry	Symphoricarpos rotundifolius	S	U	4	3-4	3	2-3	3
Sde	Mountain spiraea	Spiraea densiflora	S	U	5	5	4	4	3
Sx	Willows	Salix species	S	Spr	5	4-5	3-4	3-4	2-3
Vca	Dwarf bilberry	Vaccinium caespitosum	S	Spr	5	5	4-5	4-5	4-5
Vec	California falsehellebore	Veratrum californicum	H	-	5	4-5	4-5	5	5/5
Ŵ	White fir	Abies concolor	T	N-Spr	5	4-5	4-5	3-4	3-4
W'	Western white pine	Pinus monticola	T	N-Spr	5	5	4	4	4
Wm	Wooly mules ears	Wyethia mollis	H	Spr	5	4-5	3-4	4-5	3-4

MISCELLANEOUS FEATURES

Ba	Bare or litter-covered ground, essentially devoid of vegetation.
Gr	Grasses and other associated herbaceous plants -- includes meadows.
Hb	Herbaceous plants that are bushy in size and character of growth.
Md	Wet meadow.
Rk	Rock.

1/ T = tree; S = shrub; H = herb.

2/ Spr = sprouts following fire; N-Spr = normally will not sprout if top is fire killed; Spr,N-Spr = observed to sprout following fire in some cases and to be completely killed in others; U = post-fire sprouting capacity not yet known. Note: Some species, though killed by fire, will stump sprout following cutting in the absence of fire.

3/ Kind of animal: H = horses; C = cattle; S = sheep; G = goats; D = deer. Browse value, overall ratings, including sprouts after burning or cutting: 1 = excellent; 2 = good; 3 = fair; 4 = low; 5 = negligible or none.

4/ Includes the species and all its varieties.

5/ Poisonous under some conditions.

Table 2. - Showing some of the important characteristics of tentative soil series mapped[1]

Soil series symbol	Soil series name	Depth range[2]	Color of surface/subsoil	Reaction of surface/subsoil	Texture of surface/subsoil	Parent material	Topography & slope classes mapped[3]
7112	"Lytton"	26-52	Dark grayish brown/pale brown	Very strongly acid/strongly acid	Gravelly sandy loam/cobbly sandy loam	Andesitic agglomerate rock	Hilly to very steep (1,1D, 2,3)
7112B	"Lytton" (basalt)	26-52	Dark grayish brown/pale brown	Very strongly acid/strongly acid	Gravelly sandy loam/cobbly sandy loam	Andesitic and/or basaltic rock	Hilly to very steep (1,1D, 2)
7112G	"Lytton" (glacial)	26-52	Dark grayish brown/pale brown	Very strongly acid/strongly acid	Gravelly sandy loam/cobbly sandy loam	Andesitic agglomerate plus glacial debris	Hilly to very steep (1, 1D,2)
7112R	"Lytton" (rhyolite)	26-52	Dark grayish brown/pale brown	Very strongly acid/strongly acid	Gravelly sandy loam/cobbly sandy loam	Andesitic agglomerate and rhyolitic rock	Hilly to steep (1,1D)
7131	"Judah"	28-50	Dark grayish brown/brown	Strongly acid/ moderately acid	Rocky sandy loam/stony sandy loam	Granitic rock	Hilly to very steep (1, 1D,2)
747	"Donner"	20-44	Brown toward grayish brown/ light yellowish brown	Moderately acid/ moderately acid	Gravelly sandy loam/cobbly loam	Andesitic agglomerate	Hilly to very steep (1, 1D,2,3)

Table 2 (continued) CENTRAL SIERRA SNOW LABORATORY BASIN

Soil series symbol	Soil series name	Depth range[2]	Color of surface/subsoil	Reaction of surface/subsoil	Texture of surface/subsoil	Parent material	Topography & slope classes mapped[3]
747G	"Donner" (glacial)	20-44	Brown toward grayish brown/ light yellowish brown	Moderately acid/ moderately acid	Gravelly sandy loam/cobbly loam	Andesitic agglomerate plus glacial debris	Hilly to very steep (1,2)
747T	"Donner" (tuff)	20-44	Brown toward grayish brown/ light yellowish brown	Moderately acid/ moderately acid	Gritty loam/ loam	Tuff	Hilly to very steep (1,2)
747R	"Donner" (rhyolite)	20-44	Brown toward grayish brown/ light yellowish brown	Moderately acid/ moderately acid	Gravelly sandy loam/cobbly loam	Andesitic agglomerate and rhyolitic rock	Hilly to steep (1,2)
747W	Areas predominantly of "Donner" soils with many included seeps or wet spots.						
918	"Montez"	30-50	Dark grayish brown/yellowish brown	Very strongly acid/strongly acid	Very rocky sandy loam/ bouldery sandy loam	Morainal material (mainly granitic but some andesitic material)	Hilly (1,1D)
918W	Areas predominantly of "Montez" soils with many included seeps or wet spots.						
72X	--	--	Dark grayish brown/pale brown	Moderately acid/ extremely acid	Sandy loam/ clay	Weathered rhyolitic rock	Hilly (1)
75X	--	--	Very dark brown/ brown	Moderately acid/ strongly acid	Loam/gravelly loam	Andesitic agglomerate rock	Hilly (1)

Table 2 (continued)

1/ These are the more typical characteristics of each tentative soil series. Some variations must be expected in any characteristics listed. See descriptions of tentative soil series.

2/ Characteristic effective depth range of soil in inches.

3/ Topography terms apply to the general topographic characteristic of the tentative soil series. Symbols in parentheses are the slope classes mapped.

Table 3. - Legend for soil series and phases mapped, other than slope, with permeability, drainage, erosion hazard, mean annual precipitation, and estimated suitabilities for timber production and for extensive range use of soils listed.

Soil series symbol	Soil series name	Soil phase symbols[1]	Permeability[2]	General drainage[3]	Erosion hazard[4]	Mean annual precipitation[5]	Estimated suitabilities for Timber production[6]	Extensive range use[7]
7112	"Lytton"	3,3S,4, 4S,5	Rapid	Good to excessive	High to very high	60	Low	Low to very low
7112	"Lytton"	2E,2SE, 3E	Moderately rapid	Excessive	Very high	60	Low	Very low
7112	"Lytton'	2RE	Moderately rapid	Excessive	Very high	60	Unsuited or questionable	Very low
7112B	"Lytton" (basalt)	3,4	Rapid	Good to excessive	High to very high	60	Low	Low to very low
7112B	"Lytton" (basalt)	3SE, 3ER1	Moderately rapid	Excessive	Very high	60	Low	Very low
7112B	"Lytton" (basalt)	2RE	Moderately rapid	Excessive	Very high	60	Unsuited or questionable	Very low
7112G	"Lytton" (glacial)	3,3R1, 4	Rapid	Good to excessive	High to very high	60	Low	Low to very low
7112G	"Lytton" (glacial)	3SE	Moderately rapid	Excessive	Very high	60	Low	Very low

Table 3 (continued)

Soil series symbol	Soil series name	Soil phase symbols[1]	Permeability[2]	General drainage[3]	Erosion hazard[4]	Mean annual precipitation[5]	Estimated suitabilities for: Timber production[6]	Estimated suitabilities for: Extensive range use[7]
7112G	"Lytton" (glacial)	2RE	Moderately rapid	Excessive	Very high	60	Unsuited or questionable	Very low
7112R	"Lytton" (rhyolite)	3E,3S	Moderately rapid	Excessive	Very high	60	Low	Very low
7131	"Judah"	4R1,5	Rapid	Good to excessive	Very high	60	Low	Low to very low
7131	"Judah"	3R2,3R3, 4R2, 4R3	Rapid	Excessive	Very high	60	Low	Very low
747	"Donner"	3,4	Moderately rapid	Good to excessive	High	60	Unsuited	Low
747	"Donner"	2E,2S, 2SE,3E	Moderately rapid	Excessive	Very high	60	Unsuited	Very low
747G	"Donner" (glacial)	2ER,2ES	Moderately rapid	Excessive	Very high	60	Unsuited	Very low
747T	"Donner" (tuff)	3	Moderate	Good	High	60	Unsuited	Low
747T	"Donner" (tuff)	1E	Moderate	Excessive	Very high	60	Unsuited	Very low
747R	"Donner" (rhyolite)	3	Moderately rapid	Good to excessive	High	60	Unsuited	Low

Table 3 (continued)

CENTRAL SIERRA SNOW LABORATORY BASIN

Soil series symbol	Soil series name	Soil phase symbols[1]	Permeability[2]	General drainage[3]	Erosion hazard[4]	Mean annual precipitation[5]	Estimated suitabilities for Timber production[6]	Estimated suitabilities for Extensive range use[7]
918	"Montez"	4,4R1, 5,.5R1	Moderately rapid	Imperfect to good	High[8]	60	Low	Low
918	"Montez"	3R2,4R2, 4R3	Moderately rapid	Imperfect to good	High[8]	60	Low	Very low
72X	--	4	Slow	Good	High	60	Low	Low
75X	--	3	Rapid	Imperfect[9]	Moderate	60	Unsuited	Low

1/ See page 18 for meaning of soil phase symbols. Slope classes mapped for each soil series are given in Table 2.

2/ Permeability refers to the rate of movement of water through the soil profile. Expressions as here used are based on the least permeable layer within the soil. Relative terms used are: Slow, moderate, moderately rapid, rapid.

3/ General drainage refers to the rate and extent of removal of water from the soil, either by runoff or by percolation. Relative terms used are: Excessive, good (well-drained), imperfect, poor.

4/ Erosion hazard refers to probable susceptibility of a soil to erosion after material disturbance of protective vegetative cover. Relative terms used are: Slight, moderate, high, very high. Unless otherwise indicated, erosion hazard terms apply to soils of slope class 2 (30 to 50%).

5/ Mean annual precipitation in inches.

6/ Estimated suitability for timber production is based on predominant site index determinations in relation to soil and climatic characteristics. Suitability is not necessarily based on nor indicative of existing vegetation in an area at the time of mapping. Relative terms used on a State-wide basis are: Unsuited = nontimberland; low = sites 1,2,3,V; medium = sites 4,IV; high = sites 5, III; very high = sites 6, II; extremely high = site I; questionable = conclusive evidence of suitability for growth of commercial stands of timber is lacking.

Table 3 (continued)

7/ Estimated suitability for extensive range use is based on observations of natural forage production and use experiences over wide areas in relation to soil and climatic characteristics. Estimates apply to open areas, either natural or cleared, under extensive management (without seeding or fertilizing) and in average condition of herbaceous cover relative to kind of soil. Consideration is also given to such factors as rockiness, topography, and erosion hazard. Suitability is not necessarily based on nor indicative of existing vegetation in an area at the time of mapping. Suitability terms used are: Very low, low medium, high, very high. These terms are relative and are used by this survey on a State-wide basis. Unless otherwise indicated, they apply to soils of slope class 2 (30 to 50%). They should not be interpreted as necessarily applying to suitability of soils for forage production under more intensive management involving seeding, fertilizing, or irrigation.

8/ For soils of slopes less than 30%.

9/ Seep area.

"Lytton" Soils

The "Lytton" soils are well-drained moderately coarse textured forested soils developed in place from andesitic agglomerate rock. They are dark grayish-brown, strongly acid, and gravelly or cobbly. These soils have developed in the higher areas of the Sierra Nevada under a Humid Microthermal climate, characterized by long cold wet winters and short warm dry summers. Average annual precipitation is about 60 inches, most of which falls as snow during the winter. Mean annual temperature is about 41° F.

The "Lytton" soils are similar to the finer textured, somewhat less acid "Donner" soils, also developed from andesitic agglomerate, and to the rockier "Judah" soils developed from granitic rock.

Soil Profile: "Lytton" gravelly sandy loam.

1. 0-2" — Dark grayish-brown (10YR 4/2 dry, 10YR 2/2 moist)10/ gritty loam with moderate very fine crumb structure; very friable; very strongly acid; a few fine roots. Horizon is 2 to 4 inches thick. Overlain by 1 to 4 inches of pine and fir litter. Clear, wavy transition to:

2. 2-12" — Grayish-brown (10YR 5/2 dry, 10YR 3/2 moist) gravelly sandy loam with moderate very fine crumb structure; very friable; strongly acid; many fine roots. Horizon is 6 to 12 inches thick. Diffuse, wavy transition to:

3. 12-38" — Pale-brown (10YR 6/3 dry, 10YR 4/4 moist) cobbly sandy loam with weak very fine crumb structure; very friable; strongly acid; fewer and larger roots than horizon above. Horizon is 15 to 30" thick. Clear, irregular transition to:

4. 38-40" — Light grayish-brown (10YR 6/2 dry, 10YR 4/2 moist) cobbly sand. Friable, structureless, strongly acid, decomposed rock; a few large roots. Horizon is 1 to 4 inches thick. Abrupt, irregular transition to:

5. 40"+ — Andesitic agglomerate (tuff-breccia) rock, slightly weathered in the upper part. This parent rock is a fairly impervious mass of subangular and angular volcanic rocks cemented in a matrix of volcanic ash. It was probably deposited as a mud flow and subsequently hardened. This kind of rock may be many feet thick or it may be relatively thin and overlie rhyolitic material or the granitic foundation rock.

10/ Munsell color notations.

Range in Characteristics--The color of the surface soils dry may range toward grayish brown but are mostly dark grayish brown or very dark grayish brown. Subsoils are much paler, mostly pale brown but ranging from brown to light yellowish brown when dry. Surface soils are strongly or very strongly acid; subsoils are mostly strongly acid. In some places the subsoils are slightly less acid than the surface, in other places the reaction changes very little throughout the profile. Surface soil texture ranges from sandy loam or gritty loam to gravelly and cobbly sandy loam, with gravelly sandy loam predominant. Subsoils are mostly cobbly sandy loam but in some areas the subsoils are gravelly sandy loam. The soils are characteristically very friable throughout. Depth ranges from 26 to 52 inches except in eroded areas which may have shallower soils. In most areas there is less than 2 percent rock outcrop but in some eroded areas there is up to 15 percent exposed rock.

Parent Material Phases--Glacial action deposited at least some glacial debris over most of the basin area. The amount of glacial debris is negligible except for small localized areas. Areas of "Lytton" soils with numerous morainal granitic erratics are classified and mapped as a parent material phase. Also, in some places basaltic rock and in other places rhyolitic rock make up a significant part of the parent rock of the "Lytton" soils. Such areas are classified and mapped as parent material phases.

Topography--Mainly rolling to steep but some very steep slopes. Topography is typical of much of the high Sierra Nevada Mountains. Elevations range from about 7,000 feet to about 8,800 feet.

Drainage--These soils have a rapid permeability and drainage is good to excessive. The parent rock is fairly impervious. There are a few seeps in spots associated with these soils.

Vegetation--The "Lytton" soil areas are forested with open or semi-dense stands of conifer trees. The predominant species are California red fir, lodgepole pine, and to a lesser extent western white pine. White fir, Jeffrey pine, and mountain hemlock occur in scattered spots. The stands of trees are of all size classes, but most are made up of trees 75 to 150 years old, about 18 to 30 inches d.b.h., and about 60 to 120 feet tall. There is very little understory vegetation in the dense tree stands. In the more open stands wooly mule's ears, Pacific monardella, California helianthella, and sagebrush occur as scattered plants along with a sparse grass and forb cover. In a few places mountain whitethorn, pinemat manzanita, dwarf maple, and mountain snowberry occur on these soils. Lupines, gooseberry, Pacific red elderberry and bitter cherry are also found but in much lesser amounts.

Use--These soils are suited for timber production, although tree growth rate is relatively slow. Their use for forage production is limited. The vegetation growing on these soils provides cover and some food for wildlife.

Distribution--These soils occur on about one-fourth of the area of the Central Sierra Snow Laboratory Basin. They probably occur in other areas in the Sierra Nevada Mountains where the geology and climate are similar.

Type Location--About 1 mile south of Castle Peak. Section 1, T17N, R14E, near a jeep trail in a stand of California red fir. (Aerial photograph #2-3, Plot #V-1.)

"Lytton" Soil Phases Mapped

SYMBOL	PHASE
	Shallow, Severely Eroded
7112/2E-1	Rolling
7112/2E-1D	Nonsteep
7112/2SE-1D	Gravelly, nonsteep
7112/2RE-2	Rocky, steep
7112B/2RE-1	Rocky, rolling. Parent rock is partly or mostly basaltic.
7112G/2RE-1D	Rocky. Granitic erratics on surface.
	Moderately Shallow
7112/3-1	Rolling
7112/3-1D	Nonsteep
7112/3-2	Steep
7112/3E-2	Severely eroded, steep
7112/3S-1D	Gravelly, nonsteep
7112/3S-2	Gravelly, steep
7112/3S-3	Very steep
7112B/3-1D	Nonsteep. Parent rock is partly or mostly basaltic.
7112B/3ER1-2	Severely eroded, rocky, steep. Parent rock is partly or mostly basaltic.
7112B/3SE-1D	Severely eroded, gravelly, nonsteep. Parent rock is partly or mostly basaltic.
7112G/3-1	Rolling. Granitic erratics on surface.
7112G/3R1-1D	Rocky, nonsteep. Granitic erratics on surface.
7112G/3SE-2	Severely eroded, gravelly, steep. Granitic erratics on surface.
7112R/3E-1D	Severely eroded, nonsteep. Parent rock is partly rhyolitic.
7112R/3S-1	Gravelly, rolling. Parent rock is partly rhyolitic.
	Moderately Deep
7112/4-1	Rolling
7112/4-1D	Nonsteep

7112/4-2	Steep
7112/4S-1	Gravelly, rolling
7112/4S-1D	Gravelly, nonsteep
7112/4S-2	Gravelly, steep
7112B/4-1	Rolling. Parent rock is partly or mostly basaltic.
7112G/4-1	Rolling. Granitic erratics on surface.
7112G/4-1D	Nonsteep. Granitic erratics on surface.

Deep

7112/5-1	Rolling
7112/5-1D	Nonsteep
7112/5-2	Steep

"Donner" Soils

The "Donner" soils are well-drained medium-textured soils developed in place from andesitic agglomerate rock. They are grayish brown to brown, moderately to strongly acid, and gravelly or cobbly. These soils have only a sparse cover of predominantly herbaceous vegetation. They have developed in the higher areas of the Sierra Nevada Mountains under a Humid Microthermal climate, characterized by long cold wet winters and short warm dry summers. Average annual precipitation is about 60 inches, most of which falls as snow during the winter. Mean annual temperature is about 41° F.

The "Donner" soils are similar to the forested "Lytton" soils that have also developed on andesitic agglomerate. The "Donner" soils are of a slightly finer texture and somewhat less acid than the "Lytton".

Soil Profile: "Donner" gravelly sandy loam.

1. 0-5" Brown toward grayish-brown (10YR 5/3 dry, 10YR 3/2 moist)[11/] gravelly sandy loam with moderate very fine crumb structure; friable; moderately acid; very few fine roots. Horizon is 2 to 6 inches thick. Little or no litter cover. Clear, wavy transition to:

2. 5-20" Pale-brown (10YR 6/3 dry, 10YR 3/4 moist) very gravelly gritty loam with weak fine subangular structure; friable; moderately acid; very few fine roots. Horizon is 10 to 20 inches thick. Diffuse, irregular transition to:

11/ Munsell color notations.

3. 20-33" Light yellowish-brown (10YR 6/4 dry, 10YR 4/4 moist) cobbly gritty loam with moderate very fine crumb structure; friable; moderately acid; very few fine roots. Horizon is 10 to 20 inches thick. Gradual, broken transition to:

4. 33"+ Andesitic agglomerate (tuff-breccia) rock, slightly weathered in the upper part. This parent rock is a fairly impervious mass of a mixture of subangular and angular volcanic rocks cemented in a matrix of volcanic ash. It was probably deposited as a mud flow and subsequently hardened. This kind of rock may be many feet thick, or it may be relatively thin and overlie rhyolitic material or the granitic foundation rock.

Range in Characteristics--The color of the surface soils dry ranges from brown to grayish brown. Subsoils are paler, ranging from pale brown to light yellowish brown or very pale brown when dry. Surface soils are moderately acid for the most part but in places are strongly acid. Subsoils are predominantly moderately acid and generally less acid than the surface soils. Surface soil texture ranges from loam or gravelly loam to gravelly or cobbly sandy loam. Subsoils are predominantly gravelly or cobbly loam. The soils are characteristically friable throughout with a weak fine subangular blocky structure in the subsoils or moderate fine or very fine crumb structure throughout. Depth ranges from 20 to 44 inches. There are some shallower eroded spots and also some deeper pockets of soil in spots. In general there is less than 2 percent rock outcrop in these soil areas.

Parent Material Phases--Glacial action resulted in the deposition of at least some glacial debris over most of the basin area. The amount of glacial debris deposited is negligible except for small localized areas. Areas of "Donner" soils with numerous morainal granitic erratics are classified and mapped as a parent material phase. In areas where tuff is the parent rock or where rhyolitic rock makes up a significant part of the parent rock the "Donner" soils are classified and mapped as other parent material phases.

Topography--Mainly hilly to steep but some very steep slopes. Topography is typical of much of the high Sierra Nevada Mountains. Elevations range from about 7,000 feet to 8,600 feet.

Drainage--These soils have rapid permeability, and drainage is good to excessive except for localized spots of seeps in a few areas. Where these seeps are numerous the soil is mapped as a wet phase. Erosion hazard is high to very high, especially on the steeper slopes. The parent rock is probably fairly impervious.

Vegetation--Most of the "Donner" soil areas have a sparse herbaceous or shrub cover with only a few scattered trees. Wooly mules ears, Pacific monardella, and California helianthella occur on most areas of these soils along with many unidentified forbs and grasses. In some places sagebrush, pinemat manzanita, and California falsehellebore occur. The occasional scattered trees growing on these soils are lodgepole pine, California red fir, Jeffrey pine, and western white pine. Lupines, wild-buckwheat, willows, gooseberry, mountain whitethorn, pacific red elderberry, and prickly-phlox are also found on these soils but in much lesser amounts.

Use--These soils are probably not suited for timber production. Their use for forage production is limited. The vegetation growing on these soils provides some cover and food for wildlife.

Distribution--The "Donner" soils occur on about one-tenth of the area of the Central Sierra Snow Laboratory Basin. They probably occur in other areas in the Sierra Nevada Mountains where geology and climate are similar.

Type Location--About 1-1/4 miles N.E. of the Laboratory Headquarters. Section 12, T17N, R14E. near the end of an old jeep trail. (Aerial photograph # 2-5, Plot #V-1.)

"Donner" Soil Phases Mapped

SYMBOL	PHASE
747/2E-1D	Shallow, severely eroded, nonsteep.
747/2S-3	Shallow, gravelly, very steep.
747/2SE-2	Shallow, gravelly, severely eroded, steep.
747/2SE-3	Shallow, gravelly, severely eroded, very steep.
747/3-1	Moderately shallow, rolling.
747/3-1D	Moderately shallow, nonsteep.
747/3-2	Moderately shallow, steep.
747/3E-1D	Moderately shallow, severely eroded, nonsteep.
747/4-1	Moderately deep, rolling.
747R/3-1	Rhyolitic rock, moderately shallow, rolling.
747R/3-2	Rhyolitic rock, moderately shallow, steep.
747G/2ER2-1	Granitic erratics, shallow, severely eroded, very rocky, rolling.
747G/2ES-2	Granitic erratics, shallow, severely eroded, gravelly, steep.
747T/1E-2	Tuff, very shallow, severely eroded, steep.
747T/3-1	Tuff, moderately shallow, rolling.
747W/3-1	Seeps, moderately shallow, rolling.
747W/3-2	Seeps, moderately shallow, steep.

"Judah" Soils

The "Judah" soils are well-drained moderately coarse textured forested soils developed in place from granitic rocks. They are dark grayish brown, strongly acid, very friable, and very rocky. These soils have developed in the higher areas of the Sierra Nevada Mountains under a Humid Microthermal climate, characterized by long cold wet winters and short warm dry summers. Average annual precipitation is about 60 inches, most of which falls as snow during the winter. Mean annual temperature is about 41° F.

The "Judah" soils are similar to the less rocky "Lytton" soils developed from andesitic agglomerate and the "Montez" soils developed from morainal material.

Soil Profile: "Judah" very rocky sandy loam.

1. 0-1" Dark grayish-brown (10YR 4/2 dry, 10YR 2/2 moist)12/ sandy loam with moderate very fine crumb structure; very friable; strongly acid; a few fine roots. Overlain by 1 to 4 inches of pine and fir litter. Rock outcrop and surface rock occupy about 15 percent of the surface. Horizon is 1 to 4 inches thick. Abrupt, wavy transition to:

2. 1-11" Dark grayish-brown (10YR 4/2 dry, 10YR 2/2 moist) sandy loam with weak very fine crumb structure. Somewhat browner or paler than horizon above. Contains some gravel; many roots. Very friable; strongly acid. Horizon is 6 to 12 inches thick. Clear, irregular transition to:

3. 11-36" Brown (10YR 5/3 dry, 10YR 3/3 moist) cobbly or stony sandy loam with weak very fine crumb structure; very friable; moderately acid; many roots in upper part, fewer and larger in lower part. Horizon is 10 to 28 inches thick. Gradual, irregular transition to:

4. 36-41" Pale-brown (10YR 6/3 dry, 2.5Y 4/3 moist) stony loamy sand. Structureless; very friable; moderately acid; few larger roots. Horizon is 4 to 10 inches thick. Diffuse, broken transition to:

5. 41"+ Granitic rock. Very slightly weathered. Many feet thick.

12/ Munsell color notations.

Range in Characteristics--The color of the surface soils dry ranges from dark grayish brown to brown. Subsoils are much paler, ranging from pale brown to yellowish brown or light yellowish brown when dry. Surface soils are strongly acid. In general the subsoils are less acid than the surface soils and are moderately or strongly acid. Surface soil textures are sandy loams; subsoils are cobbly or stony sandy loam or loamy sand. The soils are very friable or soft throughout the profile. Depth ranges from 28 to 50 inches and is quite variable within short distances. Rock outcrop and surface rock occupy from 10 to 50 percent of the ground in most areas, although there are some areas with less rock outcrop.

Parent Rock--Granitic rock (granodiorite) is essentially the parent rock of the "Judah" soils. However, glacial action deposited at least some debris of mixed rocks which forms a small part of the parent material of these soils. Worn fragments of andesitic and granitic rock are found in these areas.

Topography--Mainly rolling to steep slopes. Topography is typical of much of the high Sierra Nevada Mountains. Much of the area of "Judah" soils has a somewhat benched or stair-step topography. Elevations range from 7,000 to 7,500 feet.

Drainage--These soils have a rapid permeability, and drainage is good to excessive. The parent rock is probably fairly impervious. There are a few seeps in spots in these soil areas.

Vegetation--The "Judah" soil areas are forested with open or semi-dense stands of conifer trees. The predominant species are California red fir, lodgepole pine, and to a lesser extent western white pine, white fir, and Jeffrey pine. The stands of trees are of all size classes, but most of the stands are made up of trees about 75 to 150 years old, about 16 to 30 inches d.b.h. and about 60 to 110 feet tall. Shrubs cover much of these soil areas, especially in the more open timber stands. The shrub species are mainly huckleberry oak, willow, and mountain whitethorn, with lesser amounts of pinemat manzanita, bitter cherry, quaking aspen, and mountain spiraea. In some places bracken, California helianthella, and other bushy herbs occur on these soils. Grasses and forbs are sparse except in localized spots. Sitka mountain-ash, gooseberry, western service berry, and double honeysuckle also grow on these soils.

Use--These soils are suited for timber production, although tree growth rate is relatively slow. Their use for forage production is limited. The vegetation growing on these soils provides cover and food for wildlife.

Distribution--The "Judah" soils occur on about one-tenth of the area of the Central Sierra Snow Laboratory Basin. They probably occur in other areas in the Sierra Nevada Mountains where the geology and climate are similar.

Type Location--About 1/3 mile north of the Laboratory headquarters. Section 11, T17N, R14E, west of Castle Creek. (Aerial photograph #1-5, plot #V-4.)

"Judah" Soil Phases Mapped

SYMBOL	PHASE
	Moderately Shallow
7131/3R2-1D	Very rocky, nonsteep.
7131/3R3-1	Extremely rocky, rolling.
7131/3R3-1D	Extremely rocky, nonsteep.
7131/3R3-2	Extremely rocky, steep.
	Moderately Deep
7131/4R1-1	Rocky, rolling.
7131/4R2-1	Very rocky, rolling.
7131/4R2-1D	Very rocky, nonsteep.
7131/4R3-1D	Extremely rocky, nonsteep.
7131/4R3-2	Extremely rocky, steep.
	Deep
7131/5-1	Rolling.

"Montez" Soils

The "Montez" soils are moderately well drained moderately coarse textured forested soils developed from morainal deposits. They are dark grayish brown, very strongly acid, friable or very friable, and very rocky. These soils have developed in the higher areas of the Sierra Nevada under a Humid Microthermal climate, characterized by long cold wet winters and short warm dry summers. Average annual precipitation is about 60 inches, most of which falls as snow during the winter. Mean annual temperature is about 41° F.

The "Montez" soils are similar to the "Judah" soils developed in place from granitic rock.

Soil Profile: "Montez" extremely bouldery sandy loam.

1. 0-4" Dark grayish-brown (10YR 4/2 dry, 10YR 2/2 moist)13/ slightly gravelly sandy loam with moderate very fine crumb structure; very friable; very strongly acid. A few fine roots. Overlain by 1 to 4 inches of pine and fir litter.

13/ Munsell color notations.

Boulders and stones occupy about 15 percent of the surface. Horizon is 3 to 9 inches thick. Clear, wavy transition to:

2. 4-22" Brown (10YR 4/3 dry, 10YR 2/3 moist) cobbly and slightly gravelly sandy loam with moderate very fine crumb structure; very friable; many roots. Horizon is 10 to 20 inches thick. Diffuse, irregular transition to:

3. 22-37" Yellowish-brown (10YR 5/4 dry, 10YR 4/4 moist) stony or bouldery sandy loam with weak very fine crumb structure; slightly more compact than horizons above but friable; strongly acid. Many roots in the upper part, fewer and larger roots in the lower part. Horizon is 8 to 16 inches thick. Diffuse, broken transition to:

4. 37-40" Light olive-brown (2.5Y 5/4 dry, 2.5Y 4/4 moist) bouldery gravelly loamy sand with some yellowish-brown mottles; structureless; friable; strongly acid; few roots. Horizon is 3 to 8 inches thick. Diffuse, broken transition to:

5. 40"+ Morainal deposit consisting of granitic boulders, fragments of volcanic rock, and sands from granitic and volcanic rocks. The depth of morainal material was not determined. Exposures of what appear to be bedrock granodiorite indicate that these deposits are not more than several feet thick.

Range in Characteristics--The color of the surface soils dry ranges from very dark grayish brown to dark grayish brown or dark brown. Subsoils are much paler, ranging from brown or dark yellowish brown to yellowish brown when dry. The lower horizons are more yellowish than the upper horizons. Mottling of the lower subsoils is very weak or lacking in places. The surface soils are strongly or very strongly acid. In general the subsoils are less acid than the surface soils, ranging from strongly to moderately acid. The texture of surface soils and upper subsoils is sandy loam, normally cobbly and gravelly. The lower subsoil is stony or bouldery loamy sand. Depth ranges from 30 to 50 inches and is quite variable within short distances. Stones and huge boulders occupy from 10 to 50 percent of the ground in most areas, although there are some areas of less stoniness.

One area in which there are many seeps is mapped as a wet phase.

Topography--Undulating to hilly. The many piles of boulders form a rough surface.

Drainage--These soils have rapid permeability. Drainage may be somewhat impeded, however, as the mottling in the lower subsoils indicates. The morainal material is probably permeable but the underlying bedrock is impervious to water penetration.

Vegetation--The "Montez" soil areas are forested with semi-dense or open stands of conifer trees. The predominant species are California red fir, lodgepole pine, and western white pine. There are a few Jeffrey pines and white firs growing on these soils. The stands of trees are of all size classes, but most are made up of trees about 75 to 150 years old, about 18 to 30 inches d.b.h. and about 60 to 110 feet tall. There are some shrubs in the understory, mainly willows, huckleberry oak, bitter cherry, pinemat manzanita, and mountain spiraea. In places there is a fairly dense herbaceous cover of forbs and grass. Other species growing on these soils are dwarf bilberry, mountain whitethorn, gooseberry, wild-buckwheat, double honeysuckle, California falsehellebore, red elderberry, western service berry, quaking aspen and mountain alder.

Use--These soils are suited for timber production, although tree growth rate is relatively slow. Their use for forage production is limited. The vegetation growing on these soils provides cover and food for wildlife.

Distribution--These soils occur on about one-tenth of the area of the Central Sierra Snow Laboratory. They probably occur in other areas in the Sierra Nevada where the geology and climate are similar.

Type Location--About 1/2 mile northwest of the Laboratory headquarters, just east of the road. Section 12, T17N, R14E. (Aerial photograph # 1-5, Plot #V-7.)

"Montez" Soil Phases Mapped

SYMBOL	PHASE
918/3R2-1D	Moderately shallow, very bouldery, nonsteep.
918/4-1	Moderately deep, rolling.
918/4R1-1	Moderately deep, bouldery, rolling.
918/4R1-1D	Moderately deep, bouldery, nonsteep.
918/4R2-1	Moderately deep, very bouldery, rolling.
918/4R2-1D	Moderately deep, very bouldery, nonsteep.
918/4R3-1	Moderately deep, extremely bouldery, rolling.
918/5-1	Deep, rolling.
918/5R1-1	Deep, bouldery, rolling.
918W/4R1-1	Seeps, moderately deep, bouldery, rolling.

Soils of Alluvial Material

A small part of the Central Sierra Snow Laboratory Basin has soils derived from alluvial material. These areas have only been classified as to position (bottom land or bench) and degree of wetness. Soil profiles examined show considerable soil development in some places, little in others. Parent material in places is stratified owing to differential deposition of gravel, sand, and silt. At least one profile examined indicated an older surface buried under 2 feet of more recent alluvium.

The drier soils of alluvial material support, in places, open or semidense stands of lodgepole pine and some California red fir and western white pine. The more open or treeless areas have a grass-forb cover. Patches of willows, mountain alder, and California false-hellebore also occur on these soils.

The wetter soils of alluvial material support a meadow type of grass-forb vegetation with some patches of willows, mountain alder, and California falsehellebore. Only an occasional lodgepole pine is found in the wetter areas.

Miscellaneous Soils

One mapped area of mountain alder is growing on a soil that is distinct from other soils in the basin. Also, one mapped timbered area has a soil that is distinct from other soils in the area. The general characteristics of these soils are given in Tables B and C.

Miscellaneous Land Types

Rock Land consists of areas dominantly of rock outcrop and very thin soil. More specifically, rock outcrops and surface rock with very thin soils occupy 50 to 90 percent of the area. Rock Land was classified and mapped according to the two main kinds of rock material:

1. Granitic Rock Land occupies about one-tenth of the area. Most of the Granitic Rock Land areas have a very open cover of trees and shrubs. Huckleberry oak, pinemat manzanita, mountain whitethorn, bitter cherry, and mountain spiraea are the predominant shrubs. Lodgepole pine, California red fir, western white pine, Jeffrey pine, and in places white fir and western juniper occur in these areas. These trees grow in pockets of soil or in cracks in the rocks and are in very open or scattered stands. Other species include wild-buckwheat, quaking aspen, California helianthella, wooly mules ears, and grasses and forbs.

2. Basic Igneous Rock Land occupies about one-tenth of the Laboratory area. The small areas of Basaltic Rock Land are not separated from Andesitic Rock Land on the soil-vegetation map. Most areas of Basic Igneous Rock Land have a very open cover of trees, sagebrush, and bushy herbs and a sparse cover of grasses and forbs growing in very thin soil material or in cracks between the rocks. The trees occurring in these areas are widely scattered lodgepole pine, California red fir, western white pine, and Jeffrey pine. Herb and shrub species include Pacific monardella, wooly mules ears, sagebrush, California helianthella, and wild-buckwheat.

Colluvial Land consists of areas having a heterogeneous deposit of soil material, rock fragments, or mixtures of these accumulated on slopes primarily by gravity. No granitic colluvial land was mapped. The areas of Basic Igneous Colluvial Land are not extensive. The vegetation is very similar to that on Basic Igneous Rock Land.

Rock Outcrop consists of areas having bare rock exposed over 90 to 100 percent of the area. Both Granitic Rock Outcrop and Basic Igneous (andesitic and basaltic) Rock Outcrop occur in the basin, but not extensively. The small areas of Basaltic Rock Outcrop were not separated from Andesitic Rock Outcrop on the map. There is little or no vegetation growing in these areas of Rock Outcrop.

Talus consists of accumulations of rock fragments at the foot of cliffs or steep slopes. There were no areas of Granitic Talus mapped in the Laboratory Basin. The areas of Basic Igneous Talus are small and have little or no vegetation.

Moraine Rubble Land consists of areas with 50 to 90 percent boulders and stones deposited by glacial action. Moraine Rubble Land is not extensive in the basin. An open or semidense cover of shrubs and conifer trees grows in these areas in soil material between the boulders and stones. The main species in these areas are bitter cherry, huckleberry oak, willows, quaking aspen, western service berry, lodge-pole pine, and California red fir. There are also some bushy herbs and grasses and forbs growing in soil material between the boulders.

Plant species identified in the Central Sierra Snow Laboratory Basin

Scientific name	Common name
Abies concolor	White fir
Abies magnifica	California red fir
Acer glabrum	Dwarf maple
Alnus tenuifolia	Mountain alder
Amelanchier alnifolia	Western service berry
Arctostaphylos nevadensis[1/]	Pinemat manzanita
Artemisia ludoviciana[1/]	- - sagebrush
Artemisia tridentata[1/]	Big sagebrush
Artemisia tridentata arbuscula[1/]	Black sagebrush
Astragalus bolanderi[1/]	- -
Ceanothus cordulatus	Mountain whitethorn
Ceanothus velutinus[1/]	Snowbrush
Chrysothamnus nauseosus[1/]	Rubber rabbitbrush
Eriogonum incanum[1/]	Sierra-buckwheat
Eriogonum ursinum[1/]	Bear-buckwheat
Haplopappus bloomeri[1/]	Bloomer goldenbush
Helianthella californica nevadensis[1/]	California helianthella
Juniperus occidentalis[1/]	Western juniper
Leptodactylon californicum	Prickly-phlox
Lonicera conjugialis[1/]	Double honeysuckle
Lupinus species	Lupines
Monardella odoratissima[1/]	Pacific monardella
Pinus contorta	Lodgepole pine
Pinus jeffreyi	Jeffrey pine
Pinus monticola	Western white pine
Populus tremuloides	Quaking aspen
Potentilla fruticosa[1/]	Bush cinquefoil
Prunus emarginata	Bitter cherry
Pteridium aquilinum pubescens	Bracken
Purshia tridentata[1/]	Bitterbrush
Quercus vaccinifolia[1/]	Huckleberry oak
Ribes roezlii[1/]	Sierra gooseberry
Ribes montigenum[1/]	Gooseberry currant
Salix species	Willows
Sambucus racemosa[1/]	Pacific red elderberry
Sidalcea glaucescens[1/]	Bird checkermallow
Sorbus sitchensis[1/]	Sitka mountain-ash
Spiraea densiflora	Mountain spiraea
Symphoricarpus rotundifolius	Mountain snowberry
Tsuga mertensiana	Mountain hemlock
Vaccinium caespitosum	Dwarf bilberry
Veratrum californicum	California falsehellebore
Wyethia mollis[1/]	Wooly mules ears

1/ Specimens collected and submitted to the Herbarium of the Botany Department, University of California, Berkeley.